

THE SHORE PLATFORMS OF POINT LONSDALE, VICTORIA

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Abstract

Extensive shore platforms stretch from the base of the cliffs on which the Point Lonsdale lighthouse stands. They and the rocks of the cliffs are composed of dune limestone which shows much variation in its dip. The platforms consequently truncate the rocks and are, therefore, not structural. They are covered by every tide and are, consequently, below ordinary high-tide level. They are practically horizontal, remarkably smooth, almost entirely free from detritus, and terminate by a steep drop to the sloping platform that extends indefinitely seaward. They have no ramparts, but have an abrasion ramp. Marine erosion is destroying the platforms at their seaward ends and extending their landward ends by removal of the cliff face. The platforms are characterized by irregularly shaped rock holes which are apparently mainly due to solution. Some portions of the chief platform have been isolated from the main mass, and now form 'islands' in the ocean.

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Introduction

Point Lonsdale forms the western head of Port Phillip Bay, the great indentation of the coast-line of Victoria (Fig. 1). The shore platforms at the base of the cliffs which form that headland are the subject matter of this paper. The writer is not aware of any previous description of these platforms.

The Rocks Composing the Platforms and Cliffs

The dune limestone of which the cliffs and platforms are composed is made up of varying quantities of silica, in the form of sand grains, and of calcium carbonate, in the form of minute fragments of marine shells and other marine organisms. It is a wind-blown deposit and shows its origin by the frequent and marked changes in the direction and amount of the dip of the beds. Since the formation of the dunes, there has been a solution and re-deposition of much of the calcareous material by means of which the rock as a whole has been considerably hardened, but with an unevenness that affects the degree of resistance to erosion. The actual surface of the rock is usually harder than the

interior owing, in many instances, to the greater deposition at the surface of the hardening material by capillarity. The rocks are in places pitted by the sea and, at higher levels, by the atmosphere.

From the nature of the rock, pronounced joints are few.

Excellent rock sections can be seen in the cliffs and below the surface of the platform, where that feature has been cut into by the sea.

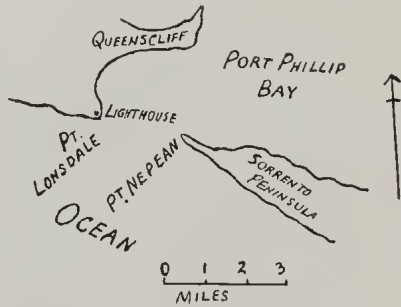


FIG. 1.—Outline map of the Point Lonsdale district.

At the top of the cliffs there is usually a band from one to four feet thick of travertine, which usually follows the surface contour of the cliffs. Below that band the dune limestone is, in places, little more than dune sand, and it may be that calcium carbonate has migrated upwards from this perhaps originally tougher portion of the limestone to form the travertine.

The Coast-line

The Point Lonsdale lighthouse stands on rocky cliffs at the junction of the ocean and bay. These cliffs extend a very short distance westward on the ocean front, unless hidden by the sand dunes which are prominent features of that front. The cliffs run northward along the bay with decreasing height until, at about half a mile, they practically die out. The average height of the cliffs is probably about 50 feet, but no exact measurements have been made by the writer.

The waves that come from the south or south-west have only a narrow shore platform to traverse before reaching the ocean shore, and so they strike that shore with considerable force; but to meet the shore just inside the bay they have to traverse the extensive shore platform to the east of Point Lonsdale, and so their power is considerably lessened. The same remark applies to those that come from more to the south-east, in which event two sets of waves may meet and tend to neutralize each other.

The southerly portion of that part of the bay cliffs above referred to appears, with certain exceptions, to be attacked only occasionally by the sea, for the cliffs, from the beach upwards, are covered by vegetation; are not undermined; and have a narrow, low fringe of wind-borne sand partly covered with short vegetation. Slight projections, however, from these cliffs occur, and these are being undermined by the sea.

Along the more northerly portion of that part of the bay cliffs above referred to, the sea reaches to the foot of the cliffs at practically every high tide, with the result that, in places, they display a 'nip' and are considerably undermined, the undermining being mainly responsible for the falls of huge masses of dune limestone and travertine from the higher parts of the cliffs, which in turn delay the action of the sea in further attacks on the cliffs.

A few small stacks of the dune limestone occur in front of the lighthouse, resting on one of the platforms the subject matter of this paper. (Pl. XIII, fig. 1.)

Some sea walls (stone and wood) and wooden groynes have been built inside the bay, and they appear to be effective in checking erosion and in building up the beach.

At Point Lonsdale the range of the spring tides is $5\frac{3}{4}$ to $4\frac{3}{4}$ feet, and of the neap tides 4 feet. This information has been kindly supplied to me by Mr. D. Stevenson, Port Officer for Victoria.

The Platforms

1. LOCATIONS AND AREAS

The platforms considered in this paper belong to the class of 'normal' platforms previously described by the writer (1939, 1940).

The chief platform is an extensive one and occurs to the west, south, east and east-south-east of the cliffs on which the lighthouse stands. A few chains west of that edifice the platform becomes discontinuous and only narrow exposures occur.

South, east and east-south-east the average width of the platform is about five chains. The eastern portion stretches as a 'peninsula' between the ocean and the bay for about 11 chains. (Pl. XIII, fig. 2.) Farther to the east and east-south-east of the 'peninsula' are considerable remnants ('islands') of the same platform, thus showing that originally there was a continuous platform of great length and of considerable width.

As to the westward of the Point Lonsdale headland, so to the northward of the same feature, the platforms sparsely occur, so that interest is centred on the platform in the immediate neighbourhood of that headland, and that portion is, in this paper, subsequently referred to for convenience as 'the main platform'.

2. DESCRIPTION OF THE MAIN PLATFORM

According to the writer's observations, the platform is completely covered by the sea at high-tide twice a day. The surface of the platform must therefore be below ordinary high-tide level.

The platform is not a structural one, since it truncates the various beds of dune limestone (Pl. XIII, fig. 3). It is divided into two parts: (a) the major portion, which is the whole platform except the abrasion ramp; and (b) the minor portion, which is the abrasion ramp.

(a) THE MAJOR PORTION is almost horizontal, with only minute surface irregularities in the form of tiny basins or dimples up to six inches in depth, features which are remarkably constant over the whole

major portion of the platform, but which are absent from the abrasion ramp (Fig. 2).

The major portion is practically entirely free from detritus of all kinds, not even any sand being visible; but on the sea bottom, below the platform, well rounded boulders and pebbles of the dune limestone are visible.

Much of the surface of the major portion is covered by living marine organisms which must afford substantial protection against marine erosion.

Many rock-holes of varying shape, size and depth stud the platform. The surface measurements run from a foot or two to 30 feet or more in length and breadth, and the depths from one to about four feet. Although these holes contain sand and large boulders and pebbles, there is no pot-hole erosion in their formation, and the occurrence of live seaweeds in some holes also supports that statement. Solution of the limestone appears to be the main cause of the holes, aided perhaps by some drying and wetting of the edges of the holes.

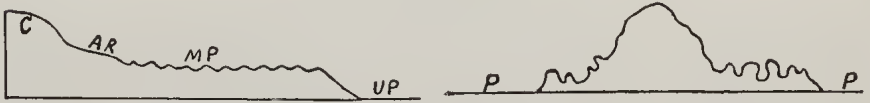


FIG. 2.—Diagrammatic section across the main platform at the lighthouse, Point Lonsdale, showing the smooth abrasion ramp (AR) and the dimpled surface of the major portion of the platform (MP). C—Cliff. UP—Ultimate platform.

FIG. 3.—Diagrammatic section through one of the small stacks standing on the platform (P) in front of the lighthouse. The hollows are due to ordinary pot-hole erosion by the waves.

True pot-holes do occur, but they are few in number. They have diameters of from six to 18 inches, and depths from a few inches to about twelve inches. Around their edges and projecting two inches above the general level there is, in places, a band of rock up to two inches thick, harder than the main mass, a fact probably due to the migration of calcium carbonate from the surrounding rock, which resulted in the formation of the holes, their shapes being determined prior to the action of the eroding agents.

Although pot-hole erosion is scanty on the platform itself, yet it is normal and pronounced above the bases of the small stacks in front of the lighthouse, where it is an active agent in the destruction of those features. The holes are frequently 18 inches to two feet in diameter and in depth. Two holes may merge in each other, with a resulting diameter up to about four feet and a depth of from two to three feet. A diagrammatic section of one of these stacks is shown in Fig. 3.

At the outer edge of the platform where it drops sharply to what the writer has hitherto termed the ultimate platform, the very changeable dip of the rocks enables the sea to undermine the platform, with the result that large slices break off and slip into the sea. In this way, as well as by the sea cutting strong channels through the platform, the area

of the latter is probably being substantially reduced; for it looks as if the destruction of the platform is proceeding faster than its extension by the retreat of the cliffs; and in this connection, a minor method of destruction is shown on the remnant of the platform about a quarter of a mile west of the lighthouse on the ocean, where the sea, arriving normal to the shore along the broken edge of the platform, turns and sweeps along the inner portion of the platform parallel to the shore, thereby reducing that portion to a lower level than the outer portion (Fig. 4).

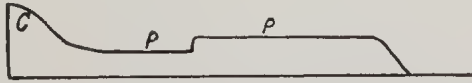


FIG. 4.—Diagrammatic section across the platform (P) about half a mile west of the lighthouse, showing the lowering by marine erosion of the inner portion of the platform parallel to the coast-line. C—Cliff.

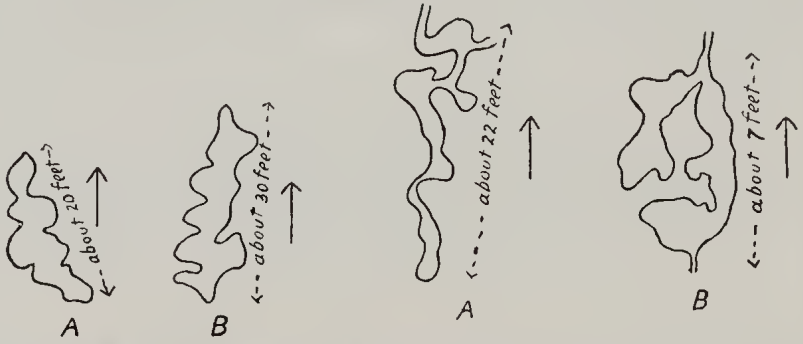
(b) THE MINOR PORTION, i.e., THE ABRASION RAMP. This, the remaining portion of the main platform, projects downward from the edge of the cliffs at an angle of from 5° to 8° from the horizontal, until it meets the major portion. The width of the ramp is variable, but probably it would average about 30 feet, so that in comparison with the major portion its size is insignificant. Nevertheless it is a strongly marked feature with variable characters.

The abrasion ramp is extended landward as the cliffs recede. At the same time its seaward edge appears to be in course of reduction, by the action of the waves, to the general level of the major portion of the platform. Thus, if the rates of removal of the cliffs and of the seaward edge of the ramp should differ, the latter may be extended or reduced accordingly. The mechanism which brings about the formation of the ramp and its destruction seems obscure.

Although the ramp has the general slope seaward stated above, yet its surface becomes mutilated in a number of ways. The fact that it is composed of the dune limestone, with its varying dips both in direction and angle, helps to bring about these surface irregularities. Thus if the rocks dip landward they become undermined by the action of the sea in that direction (Pl. XIII, fig. 3). If they dip seaward, the reverse takes place. In other instances, pot-holing may start and rapidly advance, and so wide, shallow holes develop on the surface.

Immediately to the south of the lighthouse the surface of the ramp is composed of a bed of the dune limestone, which is thicker than most other beds of the series and perhaps of slightly different chemical composition. Whilst its general surface is exceedingly smooth, yet in it closed hollows have been cut which are of unusual shape (Figs. 5A and 5B), with an average depth of from six to nine inches. They have been formed by pot-hole erosion and, in some instances, as separate hollows which have by the continued action of the sea coalesced, the resulting form having, in places, a series of curves with sharply cut spurs, and having its longer axis at right angles to the coast-line.

At about two chains west of the lighthouse similar hollows (Figs. 6A and 6B) have been formed in the abrasion ramp in ordinary dune limestone, but the narrow connecting channels between the original separate hollows are more clearly shown than in the case of the hollows shown in Figs. 5A and 5B. In these examples, also, the longer axis is at right angles to the coast-line.



FIGS. 5A and 5B.—Diagrammatic plans of the shallow hollows in the abrasion ramp in front of the lighthouse. They are cut in a bed of dune limestone of unusual thickness and surface smoothness. The arrows indicate the directions of the seaward slope.

FIGS. 6A and 6B.—Diagrammatic plans of the shallow hollows in the abrasion ramp about two chains west of the lighthouse. They are cut in the normal type of dune limestone. The arrows indicate the directions of the seaward slope.

3. ORIGIN OF THE MAIN PLATFORM

This platform (as also other platforms in its immediate vicinity) is exposed between tide-marks, and is covered by practically every tide, whether the sea be calm or rough. Its level is therefore below ordinary high-tide mark.

The dune limestone of which it is composed is a rock of moderate but varying toughness. The platform would appear to be due, in the main, to planation for the following reasons: (1) It does not come under the 'Old-Hat' type of Bartrum. (2) As already mentioned, solution (in consequence especially of the prevalence of calcium carbonate in the rock) doubtless plays an important part in the formation of the rock holes, and it may account to some extent for the unusual small irregularities on the surface of the platform, but not for the platform as a whole. (3) The cliffs are being undermined by the direct attack of the waves, and at the small stacks in front of the lighthouse wave action takes place to a height of five or six feet above the platform (Pl. XIII, fig. 1), partly by direct abrasion of the sides of the stacks and partly by the formation of large pot-holes in their lower portions. (4) No evidence was obtained that the crystallization of sodium chloride effects the disintegration of the rock; and (5) alternate wetting and drying would doubtless assist in breaking up the surface of the platform, but it is doubtful whether, by reason of the platform being below ordinary high-

tide level, there are any periods of dryness or, if there are any, whether they are of sufficient length to affect the surface of the platform.

References

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Description of Plate

PLATE XIII

- Fig. 1.—Two stacks of dune limestone resting on the platform in the ocean at the foot of the lighthouse. The lower portion of the right hand stack shows the smoothing action of the sea, whilst above, atmospheric erosion produces a rough cavernous surface.
- Fig. 2.—The main platform at the foot of the lighthouse, looking east towards the Sorrento Peninsula.
- Fig. 3.—The abrasion ramp truncating the landward dipping dune limestone. North of the pier.